09/423274
1/PRTS
420 Rec'd PCT/PTO 25 OCT 1999

USE OF AND METHOD FOR TESTING OF DOCUMENTS WITH DIFFRACTION-OPTICALLY EFFECTIVE SAFETY LAYERS

This invention relates to a use of and a method for testing of documents.

To date, documents with diffraction-optically effective safety layers, in particular holograms, have been tested with costly optical testing equipment. In these procedures, the test object has to be positioned very exactly. The entire testing process takes so long that these test procedures cannot be used in high-speed processing machines. Testing of, for example, banknotes with a hologram authenticity feature in a banknote counting machine is impossible, as it runs at high speeds between 500 and 1500 banknotes per minute and above. A method and device of forge testing holographically protected identity cards is disclosed in DE 27 47 156. The hologram is reproduced and a visual check is carried out. This method is not suited to high-speed, efficient, person-independent testing. A device for generating scanning patterns which are tested by means of laser, mirror and lens system as well as a photodetector is described in EP 0 042 946. The economic expenditure is also in this case very high. It would increase further if the test objects are to be tested without prior sorting. To avoid presorting, the forge test system would have to be arranged several times.

It is the object of the invention to eliminate the disadvantages of the prior art and to propose a use, and a method of testing, of documents with diffraction-optically effective safety layers, in particular holograms, which can be tested rapidly, person-independently and inexpensively. The device is intended for use in document testing devices and

money processing machines as well as manual test units for testing documents with diffraction-optically effective safety layers.

This problem is solved by the features given in the characterizing clause of claim 1.

Holograms and other diffraction-optically effective safety layers for the protection of certificates and other securities as well as banknotes against forging are now used more and more widely. Rapid testability is another safety stage in the valuation of diffraction-optically effective safety layers as a feature of authenticity. Diffraction-optically effective layers are composed of a metallized layer, among other things. This metallization layer is electrically conductive. The electrical conductivity changes with the thickness of the layer. The diffraction-optically effective layer has a discontinuous metallization layer and/or partially metallic layers and/or zones of metallic layers in different planes. Various measuring methods to determine an electrical conductivity are known. In practice, the non-contacting, capacitive measuring method has proved useful. This method of testing safety documents utilizes the capacitive coupling between transmitter and receiver and the transfer of energy between transmitter and receiver by bridging an electromagnetic field by electrically conductive safety materials. A downstream electronic evaluation system compares the signal picture of the test object with relevant reference signals. The comparison provides a classifying signal for reprocessing. Therefore, a document detected as a forgery, for example, could be sorted out by stopping the test device. The signal picture depends on the structure of the metallized layer of the diffraction-optically effective layer. If the diffraction-optically effective layers have a discontinuous metallization layer, several segments of the metallization layer have different electrical conductivities. Practice has shown that these different conductivities have an effect on the signal picture.

The testing reliablity is further increased by combining the electrical conductivity test with other authenticity features of the diffration-optically effective layer. The application of additional authenticity features into demetallized segments within discontinuous metallization layers and/or partially metallic layers and/or between zones of metallic layers in different planes allows the simultaneous testing of these features with the electrical conductivity. By means of the electronic evaluation system, an authenticity signal of another sensor for the authenticity determination is logically combined with the sensor for measuring the electrical conductivity. At the output of the electronic evaluation system, a signal classifying the diffraction-optically effective layer is available for reprocessing. This additional authenticity feature has fluorescent, phosphorescent or light-absorbing properties or differs from its surroundings by different magnetic properties. Therefore, an optical or magnetic sensor is used. To reduce detecting and measuring errors, a sensor carrier is used preferably. This sensor carrier accommodates all sensors required for the detection of authenticity features. This allows the distances between the sensors to be minimized and the sensors always to be arranged in defined positions. To avoid interference effects, the sensor carrier is firmly connected to the mounting plate holding the electronic evaluation system. The entire test device is arranged within the processing machine so that no additional expenditure for the transport of the test objects is required.

The features of the invention will appear from the description and drawings in addition to the claims, the individual features as individual or several things in the form of subcombinations representing advantageous, patentable embodiments for which protection is claimed here. The invention will now be explained in greater detail with reference to an embodiment thereof which is represented in the accompanying drawings, wherein

Fig. 1	is a schematic section through a processing machine with test device
Fig. 2a	is a schematic section through a hologram with demetallized segments
Fig. 2b	is a voltage-time diagram of the evaluation signal
Fig. 3a	is a schematic section through a hologram with discontinuous metallization layer
Fig. 3b	is a voltage-time diagram of the evaluation signal
Fig. 4a	is a schematic section through a hologram with UV authenticity feature
Fig. 4b	is a voltage-time diagram of the evaluation signal of the electrical conductivity test
Fig. 4c	is a voltage-time diagram of the evaluation signal of the UV sensor

The testing method according to the invention provides that appropriate sensors are installed in suitable positions of banknote counting machines. The sensors for the detection of electrical conductivity are designed in such a way that the sensor can test the banknote independently of the position of the banknote. Optical or mechanical sensors detect the presence of a banknote and provide a reference signal for the timing of the test device **4**. Simultaneously, the sensors for the forge test of the hologram are activated. Recording the entire time window from the beginning of the banknote to its end allows the position of the hologram of the banknote to be determined.

It is shown in Fig. 1 how the test device **4** is arranged on the path of banknote transport. The banknote counting machine comprises a feed wheel **1**, transport wheels **2**, a banknote guiding device **3** and a test device **4**.

Fig. 2a shows a schematic section through a hologram with a carrying layer **11** and a partially metallic layer **12**. The partially metallic layer **12** comprises several demetallized segments **13**. Fig. 2b shows the relevant evaluation signal in a voltage-time diagram.

Fig. 3a shows a schematic section through a hologram with a carrying layer **11** and a discontinuous metallization layer **14**. The discontinuous metallization layer **14** comprises segments **15**, **16**, **17**, **18**, **19** with different electrical conductivity.

Fig. 3b shows the relevant evaluation signal in a voltage-time diagram.

Fig. 4a shows a schematic section through a hologram with a carrying layer **11** and a discontinuous metallization layer **20**. The discontinuous metallization layer **20** comprises demetallized segments **21** as well as additional authenticity features. These authenticity features are fluorescent paints **22** which are excited in the test by means of UV light and are detected by means of photosensors. Preferably, the additional authenticity features are located within the demetallized segments **21**. Fig. 4 b shows the relevant evaluation signal of the capacitively working sensor testing the electrical conductivity in a voltage-time diagram. Fig. 4 c shows the response of the evaluation signal of the photosensor in a voltage-time diagram.

In the present invention, the testing of documents with diffraction-optically effective safety layers was explained with reference to an embodiment thereof. It is to be understood, however, that the present invention is not limited to the details of the description in the embodiment, as alterations and modifications are claimed within the scope of the patent claims.